	HEAT RESISTANCE			
D573 70 Hour @ 100°C [212°F]	Change in durometer hardness, maximum Points Change in tensile strength, maximum Percent Change in ultimate elongation, maximum Percent	+15 -15 -40	+15 -15 -40	+15 -15 -40
	COMPRESSION SET			
D395 Method B	22 Hours @ 100°C [212°F], maximum Percent	35	35	35
	OZONE			
D1149	100 pphm ozone in air by volume, 20% strain 37.7°C +/- 1°C [100°F +/- 2°F], 100 hours Mounting procedure D518, Procedure A	No Cracks	No Cracks	No Cracks

Stiffness at test time and temperature shall not exceed 4 times the stiffness measured at 23°C [74°F] with no time delay. The stiffness shall be measured with a quad shear test rig in an enclosed freezer unit. The test specimen shall be taken from a randomly selected bearing. A +/- 25% strain cycle shall be used, and a complete cycle of strain shall be applied with a period of 100 seconds. The first 0.75 cycle of strain shall be discarded and the stiffness shall be determined by the slope of the force deflection curve for the next 0.25 cycle of loading.

711.12 Stainless Steel Stainless steel shall conform to the requirements of ASTM A167 Type 308 or ASTM A240, Type 304.

711.13 PTFE The PTFE, filled or unfilled, shall conform to the requirements of Section 18.8 of AASHTO, LRFD Bridge Construction Specifications. PTFE resin shall conform to the requirements of ASTM D4894 or D4895.

SECTION 712 - MISCELLANEOUS HIGHWAY MATERIAL

712.02 Calcium Chloride Calcium chloride shall conform to the requirements of AASHTO M144 (ASTM D98).

712.03 Portland Cement Concrete for Concrete Curb Portland cement concrete shall meet the applicable requirements of Section 502 - Structural Concrete, and shall meet Class A requirements with the following modifications:

a. Air content shall be 5% to 8%.
b. Portland cement shall conform to the requirements of AASHTO M85 Designation for Type I, Type II, or Type III.
c. A minimum 28-day compressive strength of 34.5 MPa [5000 psi] is required.

All curb shall be cast in steel or concrete forms which will produce a satisfactory surface requiring no further finishing, rubbing or patching after the forms are removed, except for the removal of excess material along the edges. No form joint marks shall be visible when the precast curb units are set in place. Curbs with shrinkage cracks will not be accepted.

Steel reinforcement and dowels shall conform to Section 503 - Reinforcing Steel.

Dimensions The precast curb units shall be of the dimensions indicated on the plans and shall be cast in lengths of not less than 1.2 m [4 ft] nor greater than 3 m [10 ft]. Random lengths of curb less than 1.2 m [4 ft] in length may be obtained by sawing regular precast curb, if the Resident determines it necessary to meet field conditions. All curb to be set on a radius of 20 m [50 ft] or less shall be precast to fit the curve as required.

When a depressed or modified section of curb is called for on the plans or ordered by the Resident, for driveways, crossings, closures, transitions or for other reasons, the Contractor shall furnish curbing with the required modifications.

Inlets used at catch basins shall conform to the applicable requirements of Vertical Curb, Type 2 and to the shape, dimensions, and details as shown on the Standard Detail plans.

Curing The units shall be cured either by steam or water for a sufficient length of time for the concrete to obtain the minimum 28day compressive strength of 34.5 MPa [5000 psi].

a. Steam Curing Two to four hours after the concrete has been placed and

attained the initial set, the first application of steam shall be made. Forms shall be removed after the units have been cured for 24 hours. The steam shall be 100% relative humidity to provide moisture for proper hydration of cement. The steam shall be directly applied onto the concrete. During application of steam, the ambient air temperature of 55°C [130°F] is required. When discontinuing the steam application, the ambient temperature shall be decreased at a rate of 22°C [40°F] per hour until a temperature of 11°C [20°F] above the atmospheric temperature has been attained. The concrete shall not be exposed to temperature below freezing for a minimum of 6 days after casting.

b. Water Curing The units may be water cured by covering with water, saturated material, or other acceptable or approved methods that will keep the units moist for a period of 5 days.

712.04 Stone Curbing and Edging Stone for curbing and edging shall be approved granite from acceptable sources. The stone shall be hard and durable, predominantly gray in color, free from seams that impair its structural integrity and of smooth splitting character. Natural grain size and color variations characteristic of the source deposit will be permitted. Such natural variations may include bands or clusters of mineral or both of mineral crystallization that do not impair the structural integrity of the curb stone. The dimensions, shape and other details shall be as shown on the plans.

The exposed face of stone curb shall be free from indications of drill holes. Half drill holes not larger than 20 mm [¾ in] diameter will be permitted in the arris line in the plane of the back.

a. Vertical Curb shall have a top surface sawed or dressed to an approximate true plane with no depression or projection on that surface of over 3 mm [• in]. The top front arris line shall be pitched straight and true with no variations from a straight line greater than 6 mm [¼ in]. The top back arris line shall meet the same requirement except that indentations of a maximum of 9 mm [• in] will be allowed. There shall be no projection or depression on the back face that would exceed a batter of 1 horizontal on 3 vertical for a distance from the top of 75 mm [3 in].

The front face shall be at right angles to the top and shall be smooth split and have no projections greater than 25 mm [1 in] or depressions greater than 13 mm [½ in], measured from the vertical plane of the face through the top arris line for a distance

down from the top of 200 mm [8 in]. The remainder of the face shall have no projections or depressions greater than 25 mm [1 in] from the plane of the face.

The ends of the curb shall be approximately square with the planes of the top, back and face and so finished that when the sections are placed end to end with the required minimum spacing of 6 mm [¼ in] no more than 16 mm [• in] space shall show in the joint for the full width of the top surface and for the entire exposed front face. The remainder of the end may extend back no more than 200 mm [8 in] from the plane of the joint.

Drill holes through the curb will be allowed providing they are at least 225 mm [9 in] below the top and are mortared full with portland cement mortar before placing the stone.

b. Miscellaneous Stone Curb When a depressed or modified section of curb is called for on the plans or ordered by the Resident, for driveways, crossings, closures, transitions or for other reasons, the Contractor shall furnish curbing with the required modifications.

c. Curb Inlets Inlets used at catch basins shall conform to the applicable requirements of Vertical Curb, Type 1 and to the shape, dimensions, and details as shown on the Standard Detail

d. Dimensions The stone curb units shall be of the dimensions indicated on the plans and shall be cut in lengths of not less than 1.2 m [4 ft] nor greater than 3 m [10 ft]. Random lengths of curb less than 1.2 m [4 ft] in length may be obtained if the Resident determines it necessary to meet field conditions. All curb to be set on a radius of 20 m [60 ft] or less shall be cut to fit the curve as required.

e. Vertical Bridge Curb shall conform to the requirements above, except as indicated on the plans and as follows:

1. The back face of the curb stones shall have no projections or depressions greater than 25 mm [1 in], measured from the vertical plane of the back face through the arris or pitch line down to the bottom of the stone. The front face shall be finished as required for Vertical Curb, Type 1, except that it shall be finished the full distance down on the face. Bottoms of curb stones shall be approximately parallel to the top

and sawed or dressed to lay with a bedding of approximately 25 mm [1 in] for the full length of the stone.

2. Anchor holes shall be provided in the back of the stones, pitched down as shown on the plan, a maximum of 450 mm [18 in] from each end of the stone and spaced horizontally at a maximum of 1200 mm [4 ft] apart. A minimum of 2 anchor holes shall be provided in each stone.

3. The ends of stones at expansion joints between spans and at ends of the bridge shall be cut to present a vertical face when set in position, beveled to the skew angle, if any and the entire end finished in the same manner as the top.

4. The exposed edges of the stones at intermediate joints shall be trimmed square with the planes of the top and front face so that a neat, parallel joint, free from drill holes is formed between the stones. Length of stones shall be so scheduled that joints will be uniform in width along any run of curb. Joints shall be 13 mm [½ in], plus or minus 3 mm [• in]. A joint shall be provided at each curb and sidewalk contraction joint of the bridge.

5. Stones set transversely at ends of a bridge, when the grade exceeds 2%, shall have the top beveled to fit the grade of the bridge.

6. Mortar for bedding shall be composed of 1 part portland cement and 2 parts sand with sufficient water to form a workable mix. Cement, sand, and water shall conform to Section 502 - Structural Concrete.

7. Mortar for pointing shall be composed of equal parts sand and portland cement with sufficient water to form a workable mix and shall conform to Section 502 - Structural Concrete.

8. Portland cement grout shall be made the same as mortar for pointing, except that consistency shall be such that it will flow readily.

f. Curb Type 5 The exposed face shall be smooth split to an approximate true plane having no projections or depressions which will allow over 25 mm [1 in] to show between a 600 mm [2 ft] straightedge and the face when the straightedge is placed as closely as possible on any part of the face. Half drill holes not more than 75 mm [3 in]

in length and 20 mm [¾ in] in diameter will be permitted along the bottom. The arris line, top front shall be straight and true with no variation from a straight line greater than 3 mm [• in]. The arris lines at the bottom of the face shall be straight and true so that not over 25 mm [1 in] shall show between the stone and a straightedge for the full length of the stone. The ends shall be square to the length at the face and so finished that when the stones are placed end to end, no space more than 40 mm [1½ in] will show in the joint for the width of the face.

When Curbing Type 5 is required on a curve, the pieces shall be shaped as described in the table on the Standard Detail plans.

712.05 Preformed Plastic

Type of Material This section covers reflectorized plastic materials performed into rolls or ribbons of various lengths, pliability, and widths suitable for use as reflecting pavement markings on Portland cement concrete or bituminous pavement.

General Characteristics The preformed marking materials shall consist of white or yellow films with pigments selected and blended to provide the appropriate highway colors for traffic markings. Glass or ceramic beads shall be incorporated to provide immediate and continuing retroreflection. The size, quality, and refractive index of the beads shall be such that the performance requirements of this specification shall be met.

The edges of the preformed material shall be clean cut and true. The preformed plastic material may be supplied complete with a precoated, factory applied adhesive for immediate pavement application without the use of heat, solvent, or other types of adhesive for immediate pavement application without the use of heat, solvent, or other types of adhesive operations or it may be furnished with separate adhesives as recommended by the manufacturer.

The affixed material shall be capable of molding itself to the pavement contoured by the action of traffic and maintain its original dimensions and placement under normal traffic conditions at the pavement temperatures, which could occur within the State. After application, the markings shall be immediately ready for traffic.

Physical Requirements - Color Pigments shall be selected and blended to conform to standard highway colors throughout the expected life of the material. When tested by

Federal Test Method Standard 141 Method 4232, the white shall be no darker than Color Number 37778 of Federal Standard Number 595 and the yellow shall conform to Color Number 33538 of Federal Standard Number 595 (Highway Yellow Color PR#1).

Retro-Reflectivity The retro-reflective preformed film shall have a layer of reflective spheres bonded to the top surface. The white and yellow film shall have the following initial minimum retroreflectance values at 0.2° and 0.5° observation angles and 86° entrance angle as measured in accordance with the photometric testing procedures of ASTM D4061.

Retroreflectance values shall be expressed as specific luminance in millicandelas per square meter per lux ($mcdm^{-2}lx^{-1}$) [millicandelas per square foot/foot candle ($mcd\ ft^{-2}fc^{-1}$)]

	White		Yellow	
Observation Angle	0.2°	0.5°	0.2°	0.5°
SL[$mcdm^{-2}lx^{-1}$] [$mcd\ ft^{-2}fc^{-1}$]	550	380	410	250

The test distance shall be 15 m [50 ft] and the sample size a 600 mm by 750 mm [2 ft by 2½ ft] rectangle. The angular aperture of both the photoreceptor and light projector shall be 10 minutes of arc. The reference center of the sample and the reference axis shall be taken perpendicular to the test sample.

Bead Retention When tested with a 50 mm by 150 mm [2 in by 6 in] sample bent over a 13 mm [½ in] diameter mandrel with the 50 mm [2 in] dimension perpendicular to the mandrel axis, microscopic examination of the arc on the mandrel shall show no more than 10% of the beads are entrapped in the binder and less than 40% of the surface of the bead.

Application The preformed plastic material shall be capable of application to non-defective pavement surfaces that are dry and free from dirt or other foreign matter. For normal application, the pavement temperature should be at least 15°C [60°F] and rising.

Special instructions should be supplied by the vendor for application to be made at pavement temperatures below 15°C [60°F]. Application shall be according to manufacturer's recommended procedures. Plastic pavement marking materials shall only

be applied to surfaces with temperatures within the range specified by the manufacturer for optimum adhesion.

Adhesive, activators or special coatings for various types of pavement surfaces shall be provided with the preformed plastic material. Detailed information must be supplied with the material outlining required application procedures for such adhesives, activators, or special coating.

Preformed plastics shall be capable of being applied to new asphalt pavement immediately prior to the final rolling of the new surface and of being rolled into place with conventional pavement and highway rollers. The plastic material and adhesives used in such applications shall be of the type that water used on the roller to prevent asphalt pickup shall not be harmful to the successful application of the plastic.

Special equipment necessary for the successful installation of any preformed plastic material shall be available from the manufacturer of the plastic material on a lease, loan, or purchase basis.

Longitudinal lines shall be offset at least 50 mm [2 in] from construction joints of portland cement concrete pavement. When directed by the Resident, opening of 150 mm [6 in] lengths shall be left at 6 m [20 ft] intervals in edge lines not inlaid into the pavement surface that are placed on the inside of superelevated curves so as to prevent the ponding of water on the pavement surface.

712.06 Precast Concrete Units. Precast concrete units shall conform to the plan dimensions and shall meet the requirements of ASTM C478M (ASTM C478) except as modified below.

GRACE Structural Fibers or an approved equal may be used as a replacement of 6 x 6 #10 gauge welded wire fabric when used at dosage rates of 4.5 kg/m^3 [7.5 lb/yd^3] for the construction of manholes and catch basins. The material used shall be one of the products listed on the Maine Department of Transportation’s Approved Product List.

Cement shall conform to Section 701. An approved air-entraining admixture shall be added to obtain the required air content.

Aggregates shall meet the quality requirements of Section 703.01 - Fine Aggregate for

Concrete and Section 703.02 - Coarse Aggregate for Concrete except that limitations on grading and the fineness modulus may be omitted.

The concrete mix design shall be approved by the Department. Concrete shall contain 6% air content, plus or minus 1½% tolerance. All concrete shall develop a minimum compressive strength of 20 MPa [3000 psi] in 7 days or 28 MPa [4000 psi] in 28 days.

712.061 Structural Precast Concrete Units Structural precast concrete units shall conform with the dimensions shown on the plans, the requirements of this Specification and with the approved shop drawings.

Materials Materials for concrete shall conform to the requirements of Section 502.03 - Materials. Cement shall be Type I, Type II, or Type III. Coarse aggregate gradation shall comply with Section 703.02 - Coarse Aggregate for Concrete, Class A or AA or Latex. The maximum water cement ratio shall be 0.40. The minimum air content shall be 5.5%. Concrete shall contain a minimum of 15 L/m³ [3 gal/yd^3] of calcium nitrite solution or equivalent corrosion inhibitor approved by the Resident. The minimum 28 day concrete compressive strength shall be 35 MPa [5000 psi] unless otherwise stated on the plans. Concrete shall be controlled, mixed, and handled as specified in Section 502.

Material for reinforcing shall meet the requirements of Section 709.01 - Reinforcing Steel or Section 709.02 - Welded Steel Wire Fabric.

Quality Control and Quality Assurance Quality Control (QC) is the responsibility of the Contractor. The Quality Control Inspector (QCI) shall inspect all aspects of the work. Acceptance is the prerogative of the Resident. The Department's will ensure that the Contractor's QC is performing properly, verify documentation, periodically inspect workmanship and witness testing. Testing deemed necessary by the Resident in addition to the minimum testing requirements shall be scheduled to minimize interference with the production schedule.

The Contractor shall provide a private office at the casting plant for the Inspector. The office shall have an area not less than 9.3 m² [100 ft²] and shall be conveniently located to the work. The office shall be climate controlled to maintain the temperature between 18°C [64°F] and 30°C [86°F], lighted and have the exit(s) closed by a door(s) equipped with a lock and 2 keys which shall be furnished to the Inspector(s). The office shall be equipped with a desk or table having a minimum size of 1200 mm by 760 mm [4

ft by 2½ ft], 2 chairs, a telephone, a plan rack and a 2-drawer letter size file cabinet with a lock and 2 keys which shall be furnished to the Inspector(s).

The facilities and all furnishings shall remain the property of the Contractor upon completion of the work. Payment for the facilities, its' heating and lighting, telephone installation, basic monthly telephone charges and all furnishings shall be incidental to the contract.

Construction The Contractor shall notify the Resident at least five working days prior to production of the precast units. The precast units shall be manufactured at a facility that has had a minimum of five years experience in producing similar type products. The plant shall meet the requirements of AASHTO M-157.

Reinforcing steel shall be fabricated, handled, and placed in accordance with Section 503 - Reinforcing Steel. Reinforcing shall be as shown on the approved shop drawings. Clearance shall be 50 mm by 12 mm [2 in by ½ in]. If reinforcing steel is not noted on the plans or drawings, the minimum amount of steel required shall be the area of steel equal to a grid of #13 bars spaced at 450 mm [No. 4 bars at 18 in] in both directions, horizontally and vertically. Only one mat of steel is required for concrete thickness of 175 mm [7 in] or less; two mats, one each face is required for thickness greater than 175 mm [7 in].

All concrete shall be cast and consolidated in forms that will produce dense concrete with surfaces that are free of voids, stone pockets, or other irregularities. Forms shall be sufficiently rigid and accurate to maintain the member's dimensions.

The units shall be cured until design (28 day) strength is attained by one of the following methods:

a. Accelerated Curing Accelerated cure requires that concrete cure temperature attain a minimum of 50°C [120°F] and kept at this temperature for at least 8 hours. This may be accomplished with radiant heat or steam. The maximum heat rate gain during curing or the heat rate loss after accelerated curing is discontinued shall be 20°C/hour [36°F/hr].

Accelerated cure shall begin 2 to 4 hours after the concrete has been placed and has attained its initial set. The minimum concrete temperature before application

of heat is 10°C [50°F]; the maximum enclosure temperature shall be 80°C [176°F]. Temperatures shall be monitored during cure with recording thermometers.

Steam curing shall be under an enclosure to retain the live steam to minimize moisture and heat loss. Provisions shall be made to prevent surface drying until steam application begins. Steam shall saturate the enclosure to provide moisture for proper hydration of cement. The steam shall not be applied directly onto the concrete. When radiant heat is used, provisions shall be made to ensure excess water moisture is available to prevent drying of the surfaces.

Curing shall continue, after the application of the heat ceases, until design strength is attained; preference shall be given to moist curing. The minimum curing temperature shall be 10°C [50°F]. Further curing to attain design strength will not be required if a minimum of 80% of the design strength has been attained with accelerated cure.

b. Water Curing The units may be cured by covering with a water saturated material or other acceptable method(s) that will keep the units moist for a minimum of 5 days.

c. Other methods of curing, such as “membrane curing compound” or “moisture retention without heat”, may be used if approved by the Resident and performed in accordance with manufacturer’s recommendations or agreed upon procedures.

The forms shall remain in place until the concrete attains a minimum compressive strength of 21 MPa [3000 psi] and until they can be removed without damaging the member. When curing method b or c is used: the concrete shall not be exposed to below freezing temperatures for a minimum of six days after casting when Type I or II cement is used or a minimum of three days when Type III cement is used.

Acceptance of structural precast units, for each day’s production, will be determined, based on compliance with this specification and satisfactory results of concrete testing and process control test cylinders made and tested in accordance with the following standards:

AASHTO T23 (ASTM C31/C31M) Practice for Making and Curing Concrete Test

Specimens in Field

AASHTO T22 (ASTM C39) Test Method for Compressive Strength of Cylindrical Concrete Specimens

AASHTO T119 (ASTM C143) Test Method for Slump of Hydraulic Cement Concrete

AASHTO T141 (ASTM C172) Practice for Sampling Freshly Mixed Concrete

AASHTO T152 (ASTM C231) Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C1064 Test Method for Temperature of Freshly mixed Portland Cement Concrete

A minimum of 8 concrete test cylinders shall be cast to represent each continuous concrete placement. 6 of the cylinders from each test shall be cured under the same conditions as the units. Unit identification, entrained air content, water-cement ratio, slump, and temperature of the sampled concrete shall be recorded at the time of cylinder casting. All testing shall be done in the presence of the QAI. The QAI will designate the loads to be tested.

At least once a week, the Contractor shall make 4 cylinders for use by the Department. They shall be cured in accordance with AASHTO T23 (ASTM C31/C31M).

All persons performing sampling and/or testing shall hold a current certification issued by ACI or Maine Concrete Technician Certification Board or another equivalent certification.

Manufacture of the units will include all testing described within this specification and in referenced Sections.

Repairs Exposed surfaces shall be of uniform appearance; only minor repairs to remove and blend fins, patch minor spalls and to repair small, entrapped air pockets shall be permitted. Units that are cracked or require surface repairs larger than 1250 mm^2 [2 in^2] or an accumulated repair area greater than 10% of the surface being repaired may be rejected.

Tolerances Dimensional tolerances shall be in conformance with the applicable reference specification or the established industry standards for the product being

produced.

Documentation The producer of the structural precast units shall keep accurate records of aggregate gradations, concrete batching, testing, curing, and inspection activities to verify that forms, reinforcing and unit dimensions conform to these requirements. Copies of reports shall be furnished to the Resident when requested.

Marking The date of manufacture, the production lot number, and the type of unit shall be clearly and indelibly scribed on a rear, unexposed portion of each unit.

Handling, Storage and Shipping All units shall be handled, stored, and shipped in such a manner as to eliminate the danger of chipping, cracks, fracture, and excessive bending stresses. Any units found damaged upon delivery, or damaged after delivery, shall be subject to rejection.

SECTION 713 - STRUCTURAL STEEL AND RELATED MATERIAL

713.01 Structural Steel Highway bridge steel shall meet the requirements of AASHTO M 270M/ M 270 (ASTM A 709/ A 709M). The grade of steel shall be as specified on the plans.

Main load-carrying components subject to tensile stresses or stress reversal shall meet the notch toughness requirements in AASHTO M 270M/ M270, Supplementary Requirement S5, Table 9, Zone 2, for non-fracture critical steel or S6, Table 10, Zone 2 for fracture critical steel, (ASTM A 709/A 709M, S83 or S84 TABLE S1.2 or S1.3, Zone 2). Frequency of tension tests shall comply with the requirements of S1. Fracture critical material shall also comply with the supplementary requirements of S7 and S9

Impact test sampling and testing procedures shall be in accordance with AASHTO T 243M/
T 243 (ASTM A 673/A 673M).

Steel for ancillary bridge products and steel structures shall conform to AASHTO M 270M/ M 270 (ASTM A 709/A 709M) or one or more of the following:

ASTM A 36/A 36M
ASTM A 572/A 572M